LOW VOLUME APPLICATIONS OF INSECTICIDES FOR THE CONTROL OF ADULT MOSQUITOES [1]

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After the successful use of low volume aerial applications of malathion to control adult salt-marsh mosquitoes (Glancey *et al.*, 1965), additional tests were conducted to evaluate other insecticides and mixtures as low volume aerial sprays. Early in the program it became necessary to develop a portable spray unit. We wished to test application rates lower than 1 ounce per acre, and the scale and sludge from the spray tank installed in the plane, which had been used over several years with various insecticides and formulations, constantly plugged the very small openings of the orifice plates used in the Mini-Spin nozzle. We decided to bypass the plane's spray system by using a 2 gallon B & G® stainless steel spray tank pressurized to 40 p.s.i. by a carbon dioxide cylinder. A pressure regulator was used to maintain a constant pressure. The spray tank and CO_2 cylinder were strapped in place in the baggage compartment of the airplane (Figure 1). Clear plastic tubing was run from the spray tank to the pilot's compartment and hooked to an on-off valve. Another section of tubing was run forward from the valve through the fuselage and alongside the boom. All fittings were of brass. Four Mini-Spin nozzles were attached to the plastic tubing, and the nozzles were then attached to the boom (Figure 2). Thus the boom of the plane merely served as a support for a secondary plastic boom and nozzles.

The advantages offered by this system were: (1) the spray tank could be pressurized, the valve opened, and the discharge collected and measured; flow rates for the various orifice plates could be measured without the plane leaving the ground; (2) the entire assembly could be broken down and cleaned after every operation; (3) the clear plastic liner made any trash visible; and (4) the system could be mounted on any plane that has an existing boom.

The insecticides tested in this study were naled, fenthion, and mixtures of naled-malathion, naled-glycol, and fenthion-Baygon® (*o*-isopropoxyphenyl methylcarbamate). The tests were made in 50-acre plots in citrus groves naturally infested with adults of salt-marsh mosquitoes (*Aedes taeniorhynchus* (Wiedemann) predominating). Each insecticide or mixture was tested three times; one test was made in a plot with a heavy canopy, one in a plot with a medium canopy, and one in a plot with a light canopy.

The concentrated insecticides were sprayed from a Stearman airplane flying 100-foot swaths at a speed of 80 m.p.h. and an altitude of 50 to 75 feet. Since increasing the area that can be covered with the pay load of the airplane is one of the main objectives of low volume spraying, these materials were applied in the most concentrated liquid form available. Both the malathion and glycol were used as unformulated technical materials; the malathion contained 10.25 pounds of active ingredient per gallon and the glycol weighed 9.3 pounds per gallon. The naled was applied as an oil-soluble concentrate containing 14 pounds of active ingredient per gallon; the fenthion as an oil-soluble spray concentrate containing 8 pounds of active ingredient per gallon; and the Bay-

[1] Mention of a proprietary product does not necessarily imply endorsement by the U. S. Department of Agriculture.

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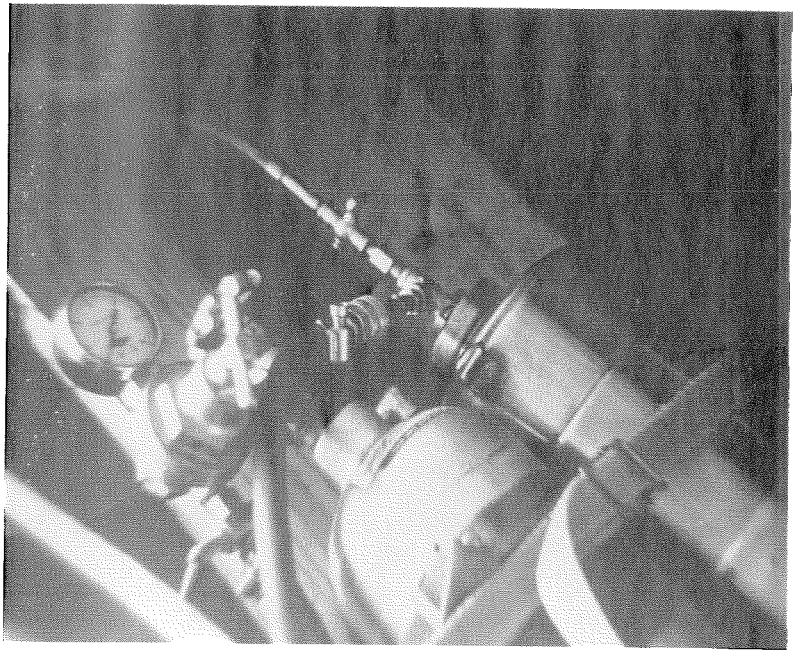

FIG. 1.—Self-contained unit used for aerial application of low volume (undiluted) aerial sprays. The unit consists of a B & G spray tank to hold the insecticide and a CO_2 cylinder with pressure regulator to provide a constant output.

gon as an emulsifiable concentrate containing 1.5 pounds of active ingredient per gallon.

Application dosages were figured on the basis of the volume of liquid (fl. oz.) and the weight of active ingredient (lbs.) per acre. The degree of control was determined by making pre- and posttreatment counts of the mosquitoes that landed on the front and back of two observers who stood side by side facing in opposite directions at 10 different locations in each of the treated areas. From these counts the number of mosquitoes per man per minute was calculated. Posttreatment counts were made after 6 and 24 hours. Attempts to make 48-hour posttreatment counts failed because of weather conditions. The results of the tests are given in Table 1.

Six hours after application, excellent control (95 percent or better) was obtained with 0.5 fl. oz. (0.05 lb.) of naled per acre, 0.5 fl. oz. (0.05 lb.) of naled plus 0.5 fl. oz. (0.04 lb.) of glycol, 0.5 fl. oz. (0.05 lb.) naled plus 0.5 fl. oz. (0.04 lb.) of malathion, and 1 fl. oz. (0.11 lb.) of naled plus 4 fl. oz. (0.32 lb.) of malathion. After 24 hours the mixture of 1 fl. oz. (0.11 lb.) of naled plus 4 fl. oz. (0.32 lb.) of malathion was the only treatment giving excellent control (97 percent). Obviously, naled at dosages as low as 0.5 fl. oz. (0.05 lb.) per acre produces early kills but does not last 24 hours. On the other hand, in tests conducted in 1964 (Glancey *et al.*, 1965), malathion at dosages of 4 fl. oz. or less produced low kills at 6 hours but high kills at 24 hours. The 1:4 mixture of naled and malathion gave very effective early and residual control.

The mixture of fenthion and Baygon was also very effective. The control with this mixture after 24 hours (93 percent) was almost as good as that with the best

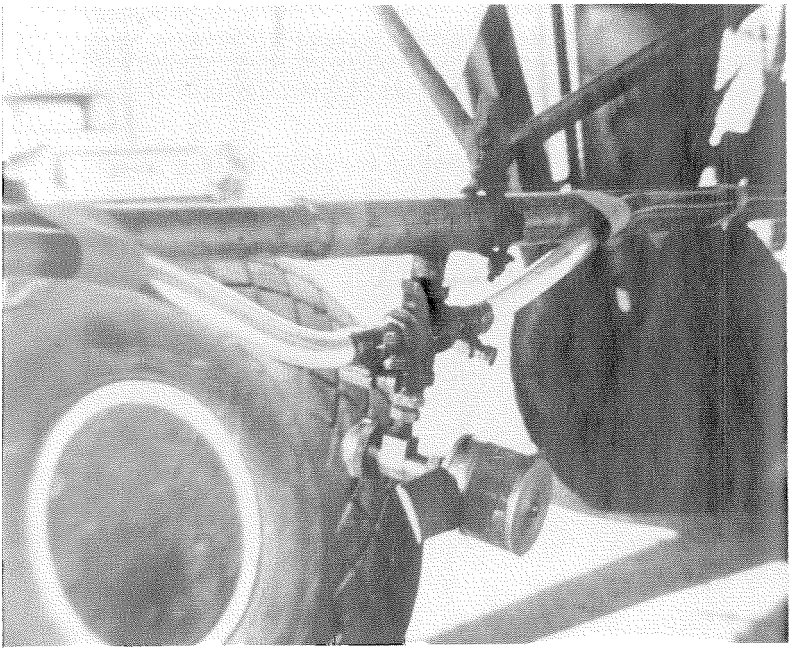

FIG. 2.—Mounting of a plastic boom and Mini-Spin nozzle. The top outlet of the tee is brazed shut to separate this experimental system from the spray system of the airplane.

TABLE 1.—Control of adult salt-marsh mosquitoes with various insecticides applied in low volume sprays from a Stearman airplane equipped with Mini-Spin nozzles. (*A. taeniorhynchus* predominating; plane speed 80 m.p.h., 100-foot swaths; 50–75 feet altitude; average of three tests.)

Insecticide	Amount per acre		Pretreatment count	Percent reduction after—	
	Pounds; Fluid ounces		(avg/man/min)	6 hours	24 hours
Naled	0.05	0.5	47	98.5	32
Naled	.05	.5	26	95	55
Glycol	.04	.5	...	....	..
Naled	.05	.5	45	98.5	59
Malathion	.04	.5	...	....	..
Naled	.05	.5	113	72	84
Malathion	.16	2.0	...	....	..
Naled	.11	1.0	118	97	97
Malathion	.32	4.0	..	..	..
Fenthion	.016	.25	49	17	42
Fenthion	.03	.5	89	49	64
Fenthion	.05	.8	139	83	93
Baygon	.02	1.6	..	..	..

naled-malathion mixture, although the total volume was only half as large and the total weight of insecticide was one-sixth as large.

SUMMARY. Field tests with low volume sprays of undiluted technical insecticides for the control of salt-marsh mosquitoes were made in Florida citrus groves. Application dosages were figured on the basis of the volume of liquid (fl. oz.) and the weight of active ingredient (lbs.) per acre. Control of 95 percent or higher was obtained 6 hours after treatment with 0.5 fl. oz. (0.05 lb.) naled per acre, 0.5 fl. oz. (0.05 lb.) naled plus 0.5 fl. oz. (0.04 lb.) malathion per acre, 0.5 fl. oz. (0.05 lb.) naled plus 0.5 fl. oz. (0.04 lb.) glycol per acre, and 1 fl. oz. (0.11 lb.) naled plus 4 fl. oz. (0.32 lb.) of malathion per acre. After 24 hours a mixture of 1 fl. oz. (0.11 lb.) naled and 4 fl. oz. (0.32 lb.) malathion gave 97 percent control, and a mixture of 0.8 fl. oz. (0.05 lb.) fenthion plus 1.6 fl. oz. (0.02 lb.) Baygon gave 93 percent control.

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STANDARDIZED FEEDING OF *AEDES AEGYPTI* (L.) MOSQUITOES ON *PLASMODIUM GALLINACEUM* BRUMPT-INFECTED CHICKS FOR MASS SCREENING OF ANTIMALARIAL DRUGS [1]

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In the course of a pilot study on the practicability of mass screening of antimalarial drugs against the parasitic stage (sporogonic cycle) in the mosquito vector, a number of techniques have been developed or improved. Techniques that are successful in a small number of tests in a research laboratory are not necessarily adaptable or efficient when applied to a line production type of drug screening.

Observations on the effect of anti-malarial drugs on the sporogonic cycle in the mosquito vector have been made by a number of investigators. Lumsden and Bertram (1940a) stated that the most delicate criterion for the estimation of the action of a drug was the development of the parasite in the mosquito. They selected the oocyst count as most suitable for their purpose. In another paper, Lumsden and Bertram (1940b) discussed the effects of plasmoquine and praequine on the subsequent development of the gametocytes

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